F. L. JENSEN

GRAPE LEAF FOLDER *control*

Field trials conducted the last two years show that dust or spray preparations using spores of the microbial insecticide, Bacillus thuringiensis, resulted in control of grape leaf folder equivalent to that obtained with carbaryl (Sevin), the current standard chemical employed against this pest.

TABLE 1. SPRAY TRIAL, 1964, THIRD BROOD GRAPE LEAF FOLDER, THOMPSON SEEDLESS, FARMERSVILLE

Material (applied Sept. 8)	Amount per 100 gallons	Gallons per acre	Average number of leaf rolls per vine, Oct. 1	Average reduction in leaf rolls compared to check
1 Check	..	..	39	..
2 Endosulfan 50% WP	1 lb.	216	29	29%
3 Carbaryl 50% WP	1 lb.	209	12	68%
4 Bacillus thurin- giensis*	1 qt.	194	13	65%

*A flowable preparation containing 30 billion spores per gram of product.

TABLE 2. DUST TRIAL, 1965, THIRD BROOD GRAPE LEAF FOLDER, THOMPSON SEEDLESS, FARMERSVILLE

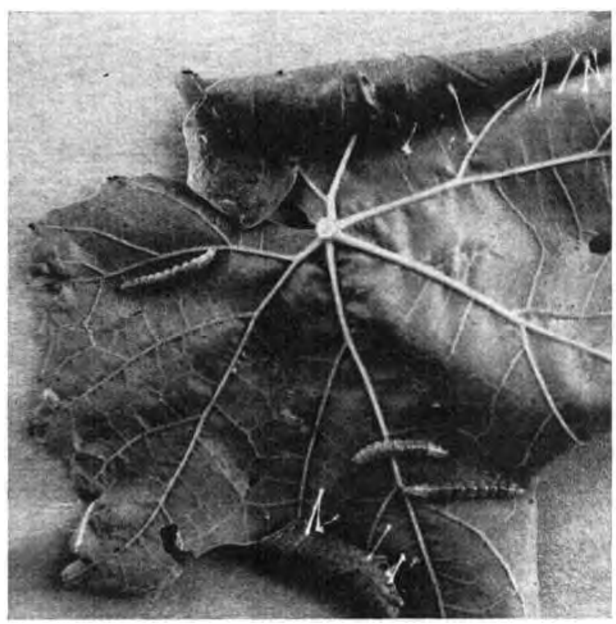
Material (applied Sept. 9)	Lbs. per acre	Average number of leaf rolls per vine, Oct. 1	Average reduction in leaf rolls compared to check
1 Check	..	109	..
2 5% Carbaryl	17	28.4	72%
3 Bacillus thurin- giensis A*	24	28.9	71%
4 Bacillus thurin- giensis B†	31	27.5	74%

* Contained 5 billion viable spores per gram of product.
† Contained 2.5 billion viable spores per gram of product.

TABLE 3. SPRAY TRIAL, 1965, THIRD BROOD GRAPE LEAF FOLDER, THOMPSON SEEDLESS, FARMERSVILLE

Material (applied Sept. 10)	Amount per 100 gallons	Gals. per acre	Average number of leaf rolls per vine, Oct. 1	Average reduction in leaf rolls compared to check
1 Check	..	..	132	..
2 Carbaryl 50% WP	1 lb.	207	7.84	94%
3 Bacillus thurin- giensis*	1 qt.	216	13.2	90%

* A flowable preparation containing 30 billion spores per gram of product.



Full grown larvae of the grape leaf folder, shown in photo above, are about ¾-inch long. The upper surface of the leaf usually forms the outside of the roll. The rolls are made by spinning strands of silk which contract and pull the leaf together. Each bunch of strands contains 200 to 300 individual filaments and about 10 such ties are needed per roll—some inside where they cannot be seen. Larvae feed on the free edge of the leaf inside the roll and make at least two such rolls during their development. They always remain inside the rolls or between leaves except when moving (at night) from one location to another. Larvae shown here and on cover were removed from inside rolls for photos.

with Bacillus Thuringiensis

THE GRAPE LEAF FOLDER (*Desmia funeralis*) has not seriously troubled vineyardists in the southern San Joaquin Valley since the rather heavy infestation from 1954 through the 1959 season. Even during the worst years, less than half of the vineyards in Tulare County required control. Since 1959, minor infestations have persisted in the Exeter area, however, and small-scale third brood control was required late in 1964. In 1965, a few vineyards required second brood control in July and additional acreage required third brood control in early September. The total acreage treated was estimated at from 1,000 to 1,500 acres. Simultaneously, moderate infestations also required control in southern Fresno County.

Although the current population upswing is no imminent threat, the history of leaf folder infestations suggests the possibility of heavy populations at some future date and the need for continued field trials to develop new control methods.

While carbaryl, endrin, parathion, methyl parathion, and standard lead arsenate (used only in first brood sprays), all give good control, interest in the microbial insecticide, *Bacillus thuringiensis*, has grown since the first commercial preparations were made available in 1959. The deleterious effects of some chemicals on beneficial insects were suspected at that time. More recently, some undesirable side effects of pesticide usage have been documented, and for this reason interest in materials like *B. thuringiensis* has remained at a high level. While perhaps not entirely harmless, its use is expected to be much less damaging to the parasites and predators that help to keep grape pests in check.

Trials with *Bacillus thuringiensis* sprays looked very promising in 1959 and 1960, although these sprays applied against the first brood in May did not show as great a carry-over effect against the second and third brood as did carbaryl. Results of trials with *B. thuringiensis* dusts during the same years were erratic, some showing good control and some poor. However, the potencies of the dusts, on the basis of the spore counts, were well below dosages used in the sprays.

The *Bacillus thuringiensis* preparations used in 1964 and 1965 were reportedly of greater potency and uniformity because of improvements in manufacturing and testing procedures.

Test procedures

Because *Bacillus thuringiensis* preparations had not been accorded federal or state registration on grapes at the time of these tests, applications could not be made before harvest. This restricted the trials to third brood infestations (September 8) in Thompson seedless vineyards harvested in mid-August for cannery use.

A randomized, complete-block design was used in the three trials reported and the results were subjected to statistical analysis. Each plot consisted of a single row of 65 vines. In the two spray trials, each treatment was replicated three times, and in the dust trial each treatment was replicated four times.

About three weeks after treatment, when all or virtually all of the remaining larvae had completed making leaf rolls, these rolls were counted for a comparison of treatments. All recognizable rolls were counted—including some second brood rolls made in July.

1964 test

The 1964 trial consisted of a comparison of spray applications of *Bacillus thuringiensis*, endosulfan (Thiodan), and carbaryl. *B. thuringiensis* dusts were not available. The results of this trial are shown in table 1. There was no significant difference (5% level) between carbaryl and *B. thuringiensis*, but both were significantly more effective than endosulfan, and the results of all three treatments were significantly better, as compared with the untreated check.

1965 tests

In 1965, both *Bacillus thuringiensis* dusts and sprays were compared with carbaryl. The results of the dust trial are shown in table 2. The two commercial preparations of *B. thuringiensis* dusts effected controls not significantly different from that obtained with carbaryl.

In the spray trial (table 3), a stabilized preparation of *Bacillus thuringiensis* was compared with carbaryl. Again, the results show no statistically significant difference between the two materials. Thus in these three recent trials, *B. thuringiensis* preparations have performed as well as the standard control, carbaryl.

More testing is required to determine whether *Bacillus thuringiensis* spray and dust preparations will show the carry-over effect of carbaryl when applied against first or second brood larvae. More trials are also necessary to determine how critical the timing of *B. thuringiensis* applications may be. In the trials reported, the applications were all made when the young larvae were about ready to make leaf rolls, which is the most favorable time for any stomach poison. The same timing can be used for carbaryl, which acts as both a stomach and contact insecticide, but this chemical is also effective when applied after the larvae are in their leaf rolls. *B. thuringiensis*, on the other hand, may or may not be as effective under these conditions at times when commercial growers often need to make such applications.

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